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MEETING THE CHALLENGE

An overview of NDT technologies and systems

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Abstract

GE Inspection Technologies constantly pushes for technical innovation in sensors, software and total systems. For any innovation to be truly valuable it must respond to the ever changing needs of the user. This is especially true for NDT applications where materials, processes, regulations and manufacturing or maintenance demands change rapidly, putting greater pressure on the provider to complete inspection tasks faster and more cost effectively without sacrificing quality. Before we bring an idea to life, GE considers all of the demands the market faces, plus one more: how can today's technology respond to tomorrow's needs?

For the primary NDT industries we serve - aerospace, power generation, oil & gas and automotive - we have worked closely with our partners to understand specific needs for in-line, field and lab systems. Rhythm, our new inspection management software for radiography is an example of this. When developing software GE considered many factors such as the growing need for ease of use so start up is fast and efficient, and the ability to access all relevant inspection data through a single interface. Also included are powerful tools to make analysis easier and more accurate, with the ability to share this data across computers or remote locations. All this combined with long term compatibility and investment benefit comes from a standards based, scalable system.

During 2006 you will have seen many new GE Inspection Technologies products reach the market, each developed around the markets needs and requirements. This presentation will review some of these innovative accomplishments and touch on what the future may hold.

1. IMAGINE

The focus of GE Inspection Technologies covers a broad range of industries and applications so that whatever the NDT need, ranging from simple to highly complex we are a proven and reliable resource. We are setting best practices today and are constantly exploring the next generation of NDT solutions, all in an effort to keep industry at the front of quality, safety and productivity.

We design, manufacture and service radiographic, ultrasonic, RVI and eddy current equipment that test materials without deforming or damaging them…..well not deliberately anyway. And these products are used in a wide range of industries including Aerospace, Power Generation, Oil and Gas, and Automotive. Planes, trains and automobiles to put it simply.

To support and promote these technologies we have 9 Application Centres around the globe offering equipment services including repair, calibration, training and upgrades with over 1,000 employees worldwide at more than 25 facilities in 25 countries.

GE is Imagination at Work--- a diversified technology, media and finance services company focused on solving some of the world's toughest problems. With products and services ranging from aircraft engines, power generation, water processing and technology to medical imaging, business and consumer financing, media content and advanced materials we in Inspection Technologies benefit from R&D, problem solving and direct interaction with other GE businesses.

Not to mention the direct interaction with the market place where we continue to observe an increasing need for corrosion detection and weld inspection to assist the requirement for improved productivity. Versatility, portability and a high degree of availability are key requirements from inspection technology solutions.

The long term aim is to work in collaboration with you to provide technology breakthroughs such as:

- Permanently installed sensors
- Real time digital radiography
- Phased array UT
- Advanced imaging software
- Advanced scanning techniques for corrosion under insulation (CUI)

Some of these technologies will be discussed at length over the course of this Conference, and may even be on display for demonstration purposes but as an overview I offer the following.

2. WALL THICKNESS MEASUREMENT

The DM series of ultrasonic thickness gauges are compact, rugged and efficient. This allows them to carry out a large number of demanding tasks, such as reading wall thickness measurements on components subject to wear.

3. FLAW DETECTION

Portable ultrasonic flaw detectors such as the USM 35X are protected against the ingress of dust and strong jets of water to the IP 66 standard. Modifications made as a result of on-site and customer trials make it more robust and suitable for application in the most aggressive operating environments.

4. WELD INSPECTION USING AUT

ASME code case 2235 allows for weld inspection on pressure vessels and piping using Automated UT (AUT). We have had considerable experience designing testing machines and UT products so can design a system to suit specific needs and requirements. We are also developing a Phased Array UT based automated system for testing girth welds on new pipelines which will offer improved speed and accuracy over traditional methods.

5. CORROSION MAPPING

The IAS 50 has been developed specifically for the Oil and Gas segment and is a complete, automated UT solution used to map and assess corrosion and base material flaws on pipelines and other critical ferrous based structures. It achieves at least 10 times more productivity over manual solutions.

One client claims that the IAS 50 “is an excellent all round mapping tool for establishing the extent of corrosion on vessels and pipes. It is uncomplicated and easy to use, lightweight and portable, whilst giving consistently reliable and repeatable readings”.

6. HARDNESS TESTING

Mobile hardness testing is becoming more sophisticated and advanced. And in these times of cost pressure and higher quality requirements it represents a quick and economical supplement to stationary hardness testing in the modern production process. The application possibilities are endless for large and smaller components, especially in positions which are difficult to access

We can offer a full range of portable Hardness Testers designed for field and shop applications. They can operate on battery or AC power and have direct digital hardness readout in Rockwell, Vickers or Brinell scales.

Also on offer are options of various methods of portable Hardness Testing eg the MIC Hardness Tester using the Ultrasonic Contact Impedence (UCI) and Rebound test methods.

7. EDDY CURRENT

This is an ideal technique for inspecting cracking in welds at or near the surface of metals, working through coatings such as paint. Our solution comprises of a Locator instrument and Weldscan probe. The Locator is a light, handheld eddy current instrument that is rugged enough for continuous use and the harsh environments associated with O&G.

Weldscan probes have been designed to be extremely hardwearing so that they can handle the rough weld surface while detecting faults in the weld.

We will go into some EC equipment and applications later in this conference.

8. COMPUTED RADIOGRAPHY & X-RAY

Computed Radiography (CR) scanners such as the CR Tower allows for digital imaging and can greatly improve productivity and safety. A digital image allows the end user to enhance a particular area of interest for precise viewing and interpretation of results. The wide exposure latitude of this technique can also reduce re-shoots due to radiographic variances.

There is also a range of Storage Phosphor Imaging Plates that give the user the ability to optimize images for unmatched quality and reduced exposure times.

For on-stream applications the IPC minimizes exposure and plant shut-down times, whilst the IPX guarantees the highest test standards in weld inspection.

And whilst film remains a traditional X-ray method it is possible for either enhancement, transmission or archiving purposes, digitisers are increasingly being sought after as an NDT tool.

9. SOFTWARE SOLUTIONS

Inspect, interpret, collaborate! The Rhythm Suite of user friendly software offers advanced image review tools and data management for all X-ray inspection modalities including computed radiography, digital radiography and film digitization.

Its advanced data sharing capabilities and wall thickness measurement software improves productivity and enables faster identification of quality problems. This leads to a reduction in production defects and better in-service asset management. Using industry-standard, non proprietary data formats, Rhythm provides an advanced and cohesive solution for data management and sharing, while creating a stable platform for future NDT software capabilities.

10. PORTABLE X-RAY SOURCES

Are designed to be reliable in some of the world's toughest conditions. Using modern compact electronics to minimise weight and provide a high power output with extremely low ripple, and a sturdy metal ceramic X-ray tube, the Eresco Series generates a high X-ray dose. This delivers the shortest exposure time, resulting in higher productivity which is what it is all about!

11. RVI

Industrial Remote Visual Imaging (RVI) origins come from the medical community and its need to view inside the human body….how many of us have been there?…..with the requirement to be minimally invasive using optical and electro-optical technologies.

RVI is a subset of Visual Testing (VT) within the engineering discipline of NDT and can be used in several different ways to;

- complement conventional test data (vibration, pressure, flow)
- support root-cause failure analysis
- serve as a stand alone inspection technique
- provide a vision system for remote tooling, loose-parts or other operations

RVI includes 4 different classes of instrument;

- Rigid Borescopes
- Fibrescopes
- Video borescopes
- CCTV Câmeras

And can be easily integrated with remote sampling and loose parts retrieval tooling, geometry based measurement, VCRs, digital still and motion capture, personal computers and the internet.

We are all patently aware that NDT systems play an important role in our every day lives. The bridge you cross daily needs to be checked to ensure that the concrete and steel are still in good shape. Car

tyres and rims have to be checked before they leave the factory to make sure they do not have any defects. And kilometers of oil and gas pipelines must be inspected to ensure their integrity when they are exposed to harsh operating environments…..so perhaps this is a good one to elaborate on?

A field deployable ultrasonic system for corrosion mapping and general flaw detection
is possibly a good place to start.

Recent legislation and increased public awareness has increased the financial, legal and corporate image risks associated with catastrophic failure of ageing industrial infrastructure. Asset owners, unwilling to accept this risk, are increasingly implementing detailed methods to assess the integrity of their mission critical infrastructure. Traditional grid based discrete thickness measurement and flaw detection techniques do not provide the necessary resolution required to verify asset integrity.

The IAS 50 is a complete turnkey system designed for automatic integrity assessment of pipelines and other critical structures.

It consists of a high performance, five channel ultrasonic testing unit coupled with a two axis motion controller and data acquisition system with application specific imaging and analysis software, and a mechanized two axis automatic scanning robot. Its available with a series of UT probes and probe holders to support a variety of automatic inspection on both curved and flat surfaces. When inspection productivity is required, the system is easily set up to scan with a 5 channel probe, cutting actual inspection time by up to 80% over a single probe configuration.

As we are all patently aware, corrosion is a predominant failure mechanism for oil and gas pipelines, industrial boilers and other ferrous based structures. The IAS 50 contains the functionality to concurrently map both internal and external corrosion providing the operator with D-scan topographic images and section views of the corroded profiles of both surfaces as well as a composite thickness profile of the inspected part.

To further support direct examination of oil and gas transmission pipelines the unit contains an analysis package that allows the operator to choose interaction rules based on API 1163 to create critical failure paths for loading into the industry standard RSTRENG and ASME B31G. Based on options chosen by the operator, the system calculates the maximum allowable Operating Pressure (MAOP) for a given pipeline section.

The IAS 50 is easily configured to an automated, multi-channel ultrasonic flaw detection system used to accurately locate and size flaws within inspected components.

In flaw detection mode, the operator has the flexibility of setting the instrument up to concurrently display the A-scan of each ultrasonic channel complete with DAC/TCG curve, evaluation gates, gain, and other important channel settings.

Once the inspection plan is programmed into the system, the unit will automatically scan a part and provide a C-Scan image of the scanned area for further evaluation and analysis.

So let’s take evaluation and analysis to another level…….I’ve got RHYTHM…..all I need is the music!

So let me sing the praises of the Rhythm suite of user-friendly proprietary software which offers advanced image review tools and management including computed radiography, digital radiography and film digitization.
The Rhythm suite of user-friendly proprietary software offers advanced image review tools and data management for all x-ray inspection modalities including Computed Radiography, Digital or Direct Radiography, and Film Digitisation. Its advanced data sharing capabilities allow significant improvements in productivity and enabling identification of quality problems, leading to reduced production defects or better in-house asset management. Using industry standard non-proprietary data transfer formats, Rhythm provides an elegant solution to data management and sharing needs, whilst creating a stable base for future NDT software capabilities.

The new Rhythm software suite comprises three individual applications: Rhythm Acquire; Rhythm Review; and Rhythm Archive, all of which use off the shelf hardware. Rhythm Acquire interacts with the inspection source to collect the information which it passes onto Rhythm Review. It contains a database with relevant inspection techniques and can control the inspection equipment. Rhythm Review, which can also accept data from other Rhythm review workstations with removable media, such as CD and DVD, provides application tools for analysis, enhancement, measurement, and storage of received data. Rhythm Archive provides both on-line and near-line data storage, to allow simplified information sharing and faster access to information.

All data is saved and transferred in DICONDE format, an adaption of the DICOM standard developed by the medical sector, which is fast gaining an acceptance in industry as the preferred data transport technology. DICONDE compliancy ensures that operators are not restricted by current, proprietary formats, eliminates the need for future data conversion and simplifies data integration from other NDT information systems, such as pipe management databases.

One of the major factors which allows this software to increase inspection efficiencies is its integral range of advanced, application specific tools. These include a thickness measurement tool to detect local corrosion in projection radiographic use of tangential or penetration wall measurement techniques; a tool to measure the loss of material around a porosity; a tool which simulates the conventional film method of laying 2 or 3 films of different sensitivity on top of each other to create different depths of view; and a tool which can be used to measure the depth of a defect by showing material loss.

The new system also features extensive built-in functionality. DICONDE can be exported in other file formats, such as jpeg and tif and a copy of Rhythm DICONDE viewer can be included on a burnt disc to allow the copy to be displayed on any standard Windows PC. An archive index tool allows location and identification of specific inspected component archives, advanced filters enhance the visibility of low contrast features in digital radiographs and there are various tools to perform mathematical and geometric analysis.

That's Rhythm for you!!

12. CONCLUSION

And the music…..well before we get to that I have to say that I have only scratched the service of what we have in our bag of tricks, smoke and mirrors but I am sure that you recognize that todays and tomorrow's challenges present an opportunity for us to do what we do best – imagine and build innovative solutions that benefit you, your clients, and society at large. We call it "ecomagination", a GE initiative to aggressively bring to market new technologies that will assist us all to meet pressing environmental and safety issues. We consider it our future and will continue to establish relationships and focus our unique energy, technology, manufacturing, and infrastructure capabilities to develop tomorrow's solutions such as solar energy, hybrid locomotives, fuel cells, lower emission aircraft engines, lighter and stronger materials, efficient lighting and water purification technology. All to be achieved by using your expertise and experience in conjunction with our NDT technologies.

13. REFERENCE

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14. KEY WORDS

NDT
Phased Array
Rhythm
RVI
DICONDE